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FEEDER FOR SURFACE MOUNTING DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a feeder for a surface mounting device. More particularly, the invention relates to a feeder for a surface mounting device which carries surface mounting parts to a parts suction position of a nozzle of the surface mounting device for sucking surface mounting parts and mounting them on a printed circuit board.

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Description of the Related Art

A surface mounting device includes an X-Y gantry, a module head, a PCB carrier, and a feeder. The module head is assembled to the X-Y gantry so as to be movable in the X-Y axis direction. The module head sucks surface mounting parts (hereinafter referred to as "parts") carried by the feeder and mounts them onto a printed circuit board carried by the PCB carrier. The feeder will now be described with reference to the accompanying drawings.

As illustrated in Fig. 1 and Fig. 2, the feeder includes a vinyl recovery unit 10, a vinyl separation unit 20, and a feeding unit 30. A recovery reel 11 is mounted at the vinyl recovery unit 10. The recovery reel

11 winds vinyl (reference numeral V in Fig. 3) received from the vinyl separation unit 20 to recover the same. A tape (reference numeral TF in Fig. 3), to which the vinyl V recovered by the vinyl recovery unit 10 is bonded is fed to the feeder 30 from a tape take-up unit 50 (shown in Fig. 2) installed at a rear end of the vinyl recovery unit 10. The tape TF fed to the feeder 30 is moved by the feeder a predetermined amount for each movement and is carried to a work position. Then, parts provided on the tape TF are sucked by a nozzle (reference numeral N in Fig. 2), moved to a printed circuit board (not shown), and mounted thereon.

The construction of each element of the feeder will now be described with reference to Fig. 2. As illustrated in Fig. 2, the vinyl recovery unit 10 includes the recovery reel 11, a recovery rotation motor 12, a recovery unit worm 13, a recovery unit worm gear 14, and a recovery unit gear 15. The vinyl separation unit 20 includes a separation rotation motor 21, a separation unit worm 22, a separation unit worm gear 23, a first separation unit gear 24, a second separation unit gear 25, and a third separation unit gear 26. The parts feeding unit 30 includes a feed rotation motor 31, a feed worm 32, a sector gear 33, a first arm 34, a second arm 35, and a driving wheel 36 with driving teeth 36a.

At the vinyl recovery unit 10, the recovery

rotation motor 12, which generates a rotating force for rotating the recovery reel 11, is fixedly installed. At the central axis of rotation of the recovery rotation motor 12, the recovery unit worm 13 is installed. The recovery unit worm 13 is interlockingly rotated by the rotation of the recovery rotation motor 12, and the recovery unit worm gear 14 is rotated by the rotation of the recovery unit worm 13. The recovery unit worm 13 and the recovery unit worm gear 14 change the direction of rotational force generated by the recovery rotation motor 12 and transfer the same to the recovery unit gear 15. The recovery unit gear 15 having received the rotating force winds the vinyl V shown in Fig. 3 to recover the same onto the recovery reel 11 by rotation thereof in a predetermined direction.

The vinyl V is carried to the vinyl separation unit 20. With respect to the vinyl separation unit 20, the rotating force generated by the vinyl rotation motor 21 is transferred to the separation unit worm 22 positioned at a central axis of rotation of the vinyl rotation motor 21. The rotation force transferred to the separation unit worm 22 is transferred to the separation unit worm gear 23 positioned adjacent to and in rotational communication with the separation unit worm 22. In this process, the rotational direction is changed upon transfer of the rotational force to the first separation unit gear 24. The first separation unit gear

24 is positioned adjacent to and in rotational communication with the second separation unit gear 25 and the third separation unit gear 26. The second separation unit gear 25 and the third separation unit gear 26 are rotated in opposite directions to each other via the rotation of the first separation unit gear 24.

While the second separation unit gear 25 and the third separation unit gear 26 are rotated in opposite directions to the first separation unit gear 24, the vinyl V attached to the tape TF inserted between the first separation unit gear 24 and the second separation unit gear 25 is separated therefrom and carried to the vinyl recovery unit 10. That is, the tape TF is moved along the bottom of a cover 41, as shown in Fig. 3, by the rotation of the tape take-up unit 50. The tape TF moved to the cover 41 is carried to a suction position A at which point the vinyl V attached to the tape TF is removed. As shown in Figure 3, the tape TF has a plurality of part mounting grooves L formed at a constant interval, and parts are mounted inside each of the part mounting grooves L. The part mounting groove L with a part mounted thereto is carried to the suction position A of the nozzle N, and a shutter 42 assembled at a cover 41 is opened so that the nozzle N can suck the part and carry it to a printed circuit board.

To carry the tape TF a predetermined interval, a plurality of transfer holes H are formed on one side of

the tape TF a predetermined interval apart. To carry the tape TF having the transfer holes H formed at a predetermined interval at a constant pitch interval, the feeding unit 30 is provided positioned below the tape TF. In the feeding unit 30, a rotating force is generated by the feed rotation motor 31 in order to carry the tape TF at a constant pitch interval. The rotating force generated by the feed rotation motor 31 is transferred to the feed worm 32 provided at a central axis of rotation of the feed rotation motor 31, and the sector gear 33 positioned below the feed worm 32, as shown in Figure 2. When the sector gear 33 is driven, the first arm 34 and second arm 35 assembled to the sector gear 33 are driven to rotate the driving wheel 36, which is provided at one end of the second arm 35, at a constant pitch. Driving teeth 36a provided on the outer circumferential surface of the driving wheel 36 at a constant interval are inserted into the transfer holes H formed in the tape TF. By the rotation of the driving wheel 36, the driving teeth 36a carry the tape TF at a constant pitch to move the parts to the suction position A. A reverse rotation preventing member 37 provided adjacent a driving wheel 36 prevents reverse rotation of the driving wheel 36.

In the above-described feeder of the conventional art, since a large number of elements including a rotation motor, a worm gear, and a linking gear are used

for driving the vinyl recovery unit, the vinyl separation unit, and the parts feeding unit, respectively, the structure is complex and the number of assembling processes is large. In addition, the driving wheel carrying the tape at a constant pitch is provided with the reverse rotation preventing member, thus preventing adjustment of the position of the tape if a part deviates from a designated position.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a feeder for a surface mounting device in which the construction of the feeder is simplified by forming integrally a parts feeding unit for carrying the tape and parts at a constant pitch, and enabling a forward/backward rotation to provide for adjustment of the feed position of the tape.

It is another object of the present invention to provide a feeder for a surface mounting device in which a parts feeding unit is formed integrally, thus performing an assembling process easily, and a forward/backward rotation of the tape is possible, for adjusting the feed position of the tape.

To achieve the above object, there is provided a the feeder for a surface mounting device comprising: a main frame; a parts feeding unit including a

forward/backward rotation force generating means being installed at one side of the main frame and for carrying a tape at a predetermined pitch interval by forwardly/backwardly rotating a circular permanent magnetic unit by a magnetic force generated between a plurality of armature coils and the permanent magnetic unit, a driving gear for receiving the forward/backward rotation force generated from the forward/backward rotation force generating means by means of a gear and simultaneously carrying the tape at a constant distance by the formation of driving teeth at the circumference surface thereto to be inserted to a tape transfer hole, a position sensing unit assembled to an end of the driving gear and for sensing the position of the circular permanent magnetic unit by an absolute position sensing device; a vinyl separation unit being connected to a side of a parts feeding unit by a first separation unit gear, and carrying the vinyl removed from the tape by the forward force generated from the forward/backward rotation force generating means or re-carrying the vinyl by the backward rotating force; and a vinyl recovery unit being connected to the vinyl separation unit by a belt, and recovering the vinyl by winding the same by the rotating force transferred from the vinyl separation unit through the belt or discharging the vinyl to the vinyl separation unit by the backward rotating force.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a feeder for a surface mounting device according to the conventional art;

Fig. 2 is a front view of the feeder as shown in Fig. 1;

Fig. 3 is a perspective view of a shutter as shown in Fig. 1;

Fig. 4 is a front view of a feeder for a surface mounting device according to the present invention;

Fig. 5 is a perspective view of a driving unit as shown in Fig. 4;

Fig. 6 is a side cross-sectional view of the driving unit as shown in Fig. 5;

Fig. 7 is a perspective view of a driving gear and a feeding unit gear as shown in Fig. 4; and

Fig. 8 is a side cross-sectional view of the driving gear and the feeding unit gear as shown in Fig. 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings.

Fig. 4 is a front view of a feeder for a surface mounting device according to the present invention. Fig. 5 is a perspective view of a driving unit as shown in Fig. 4. Fig. 6 is a side cross-sectional view of the driving unit as shown in Fig. 5.

The feeder for the surface mounting device according to the present invention includes a parts feeding unit 110 installed at one side of a main frame 100 and having a plurality of armature coils 113 and a circular permanent magnetic unit 117 facing the plurality of armature coils 113 and positioned a predetermined distance away. The parts feeding unit 110 carries a tape TF at a predetermined pitch interval by a forward/backward rotation force generated by the rotation of the circular permanent magnetic unit 117 due to the interaction between the armature coils 113 and the circular permanent magnetic unit 117, and senses a rotation speed with a position sensing unit 114 for sensing the position of the circular permanent magnetic unit 117.

The feeder further includes a vinyl separation unit 120 assembled on the main frame 100, which is

rotationally connected to the parts feeding unit 110 and which carries the vinyl V removed from the tape TF via the rotating force generated by the parts feeding unit 110 or carries the vinyl V by a backward rotating force. The feeder additionally includes a vinyl recovery unit 130 assembled at the other end of the main frame 130, which is connected to the vinyl separation unit 120 by a belt 133 and which is configured to recover the vinyl V by winding the same via the rotating force transferred from the vinyl separation unit 120 through the belt 133, or discharge the vinyl V to the vinyl separation unit 120 by a backward rotating force.

The construction and operation of the present invention will now be described in more detail.

The feeder for the surface mounting device of the present invention includes the parts feeding unit 110, the vinyl separation unit 120, and the vinyl recovery unit 130. The parts feeding unit 110 is installed on one side of the main frame 100, and the vinyl recovery unit 130 is installed on the other side of the main frame 100. The vinyl separation unit 120 is assembled between the parts feeding unit 110 and the vinyl separation unit 130.

The tape TF is fed to the feeding unit 110 from a tape take-up unit 50 installed at a rear end of the vinyl recovery unit 130 along an upper side of the main frame 100. When the vinyl V is separated from the tape TF fed to the parts feeding unit 110 and a part is

carried to and positioned at a suction position O, a nozzle N is moved in a vertical direction to suck the part and carry it to a printed circuit board (not shown). After the suction of the part, the tape TF is discharged to the outside through a bottom of one end of the main frame 100. In order for the nozzle N to suck the part, the vinyl V must be separated from the tape TF and wound onto the vinyl separation unit 120. When carrying the tape TF, if the parts are not accurately carried and positioned, the tape TF may have to be backwardly carried so that the nozzle N can suck the part.

In order to backwardly carry the tape TF by providing forward/backward rotation of the parts feeding unit 110 the parts feeding unit 110 has a plurality of armature coils 113 arranged in a circle and a circular permanent magnetic unit 117 facing the plurality of armature coils 113. The forward/backward rotating force is generated by the interaction between the armature coils 113 and the circular permanent magnetic unit 117. The circular permanent magnetic unit 117 is formed of a plurality of N polar permanent magnets 117a and S polar magnets 117b arranged in turn.

A driving gear 116 includes driving teeth 116a configured to be inserted into a plurality of transfer holes H formed in the tape TF. The driving gear 116 carries the tape TF to the suction position O or backwardly carries the tape TF to the suction position O

using the forward/backward rotating force generated by the armature coils 113 and the circular permanent magnetic unit 117 through a gear 124. To carry the tape TF to the suction position or backwardly carry it and to sense a rotation speed generated from the circular permanent magnetic unit 117, the driving gear 116 has a position sensing unit 114 installed at the position at which the circular permanent magnetic unit 117 is installed. The rotation speed sensed by the position sensing unit 114 is used by a controller (not shown) to precisely control the tape TF on which a part (not shown) is packaged and carried to the suction position O of the nozzle N.

The parts feeding unit 110 and the vinyl separation unit 120 are connected so that they are synchronized. The vinyl separation unit 120 is rotated to carry the vinyl V taken off from the tape TF by the rotating force generated from the parts feeding unit 110, or to re-carry the vinyl V to the parts feeding unit 110 by the backward rotating force. That is, when the parts feeding unit 110 carries the tape TF to the suction position O of the nozzle N by rotation, the vinyl separation unit 120 is rotated to discharge the vinyl separated from the tape TF to the vinyl recovery unit 130.

In a case that the parts feeding unit 110 backwardly carries the tape TF by backward rotation, the

vinyl separation unit 120 is synchronized with the parts feeding unit 110 and backwardly rotated to re-carry the vinyl V to the parts feeding unit 110. The vinyl recovery unit 130 is synchronized with the parts feeding unit 110 and the vinyl separation unit 120. That is, the vinyl recovery unit 130 is connected to the vinyl separation unit 120 by the belt 133.

The construction of the parts feeding unit 110, the vinyl separation unit 120, and the vinyl separation unit 130 will now be described in more detail. Firstly, the parts feeding unit 110 includes a first disc member 111, a position sensing unit 114, a feeding unit gear 115, a driving gear 116, a circular permanent magnetic unit 117, a second disc member, and a feeding unit gear 119.

The first disc member 111 is fixedly assembled at one side of the main frame 100 and has a plurality of armature coils 113 assembled on a plane at a predetermined interval and a rotating shaft 112 rotatably installed at a center or central axis of the first disc member 111. The first disc member 111 is provided with a ball bearing 111a so that the rotating shaft 112 can be smoothly rotated. At one end of the rotating shaft 112, the second disc member 118 is fixedly installed.

The second disc member 118 is interlockingly rotated with the rotating shaft 112. At the bottom of

the second disc member 118, the circular permanent magnetic unit 117 is connected thereto. The circular permanent magnetic unit 117 generates a forward/backward rotating force due to the interaction of the circular permanent magnetic unit 117 with the armature coils 113, thereby rotation the rotating shaft 112.

At one end of the rotating shaft 112, the feeding unit gear 119 is installed. The feeding unit gear 119 is inserted onto the rotating shaft 112 and is assembled adjacent the second disc member 118 with a predetermined interval therebetween, and is configured to be interlockingly rotated with the rotating shaft 112. The feeding unit gear 119 engages with a gear 124, as shown in Fig. 4. The feeding unit gear 119 engaged with the gear 124 rotates the driving gear 116 using the forward/backward rotating force transferred from the gear 124.

By the rotation of the driving gear 116, the tape TF is carried to the suction position O, or is backwardly carried. To carry the tape TF at a constant pitch interval, driving teeth 116a are formed on an outer circumferential surface of the driving gear 116 at a constant interval, as shown in Figs. 7 and 8. The driving teeth 116a are inserted into transfer holes (similar to those shown as reference numeral H in Fig. 3) formed in the tape TF and are rotated at a constant pitch interval by the rotation of the driving gear 116,

thereby carrying the tape TF to the suction position O or backwardly carrying it.

The feeding unit gear 119 is installed on the rotating shaft 112 on which the armature coils 113 and circular permanent magnetic unit 117 are assembled. The feeding unit gear 115, auxiliary gear 115a, and driving gear 116 are inserted onto a shaft 112a of the position sensing unit 114, as shown in Fig. 7.

A rotation speed signal generated by the position sensing unit 114 is transferred to the controller (not shown) which precisely adjusts the feed operation of the tape TF. In this embodiment, the position sensing unit 114 is assembled at one end of the driving gear 116. The position sensing unit may be an absolute position sensing device.

The vinyl separation unit 120 is directly connected to the feeding unit 110. That is, the feeding unit gear 119 of the feeding unit 110 and a first separation unit gear 121 are connected, and thus the forward/backward rotating force of the feeding unit gear 119 is transferred to the first separation unit gear 121.

The vinyl separation unit 120 includes the first separation unit gear, a second separation unit gear 122, and a vinyl discharge gear 123. The first separation unit gear 121 transfers the forward/backward rotating force of the feeding unit gear 119 to the second separation unit gear 122. The second separation unit

gear 122 is connected to one end of the first separation unit gear 121 to thus transfer the forward/backward rotating force received from the first separation unit gear 121 to the vinyl discharge gear 123.

The vinyl discharge gear 123 includes a plurality of gears and is rotated in the backward direction to carry the vinyl V to the vinyl recovery unit 130 when it receives the rotating force from the second separation unit gear 122, or to re-carry the vinyl V to the parts feeding unit 110 when it receives the backward rotating force from the second separation unit gear 122. The vinyl recovery unit 130 is connected to the first separation unit gear 121 of the vinyl separation unit 120 by the belt 133.

The vinyl recovery unit 130 includes a recovery unit gear 131 and a recovery reel 132. The recovery unit gear 131 is connected to the first separation unit gear 121 by the belt 133 to receive the forward/backward rotating force of the first separation unit gear 121. The recovery unit gear 131 is synchronized with the recovery reel 132. Thus, the recovery reel 132 rotates when the parts feeding unit gear 110 adjusts the feed position of the tape TF, thereby either recovering the vinyl V by winding it around the recovery reel 132 or returning the recovered vinyl V to the vinyl separation unit 120.

As can see from the above, the feeder for carrying

the tape at a constant pitch is formed integrally, improving a feed rate and simplifying the constitution of the feeder. In addition, the feeding unit, vinyl separation unit, and vinyl recovery unit are rotated in synchronization with one another, thus enabling forward/backward rotation to adjust the feed position of the tape.

As explained above, the feeder for the surface mounting device of the present invention can improve a feed rate and simplify the construction of the feeder by forming the feeder so that it carries the tape at a constant pitch. In addition, the feeder unit, vinyl separation unit, and vinyl recovery unit are rotated in synchronization with one another, thus enabling a forward/backward rotation to adjust the feed position of the tape.